Allison Transmission®

# Mechanic's Tips

## V730
## Hydraulic Controls

MT1494EN

MT1494EN

# Mechanic's Tips

## Allison Transmission

### V730
### Hydraulic Controls

January 19, 1994

**Allison Transmission, Inc.**
P.O. Box 894 Indianapolis, Indiana 46206-0894
www.allisontransmission.com

Printed in U.S.A.

Copyright © 2007 Allison Transmission, Inc.



# IMPORTANT SAFETY NOTICE

IT IS YOUR RESPONSIBILITY to be completely familiar with the warnings and cautions described in this handbook. These warnings and cautions advise against the use of specific service methods that can result in personal injury, damage to the equipment, or cause the equipment to become unsafe. It is, however, important to understand that these warnings and cautions are not exhaustive. Allison Transmission could not possibly know, evaluate, and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way. Consequently, Allison Transmission has not undertaken any such broad evaluation. Accordingly, ANYONE WHO USES A SERVICE PROCEDURE OR TOOL WHICH IS NOT RECOMMENDED BY ALLISON TRANSMISSION MUST first be thoroughly satisfied that neither personal safety nor equipment safety will be jeopardized by the service methods selected.

Proper service and repair is important to the safe, reliable operation of the equipment. The service procedures recommended by Allison Transmission and described in this handbook are effective methods for performing service operations. Some of these service operations require the use of tools specially designed for the purpose. The special tools should be used when and as recommended.

# TABLE OF CONTENTS


| Paragraph | Description | Page |
|---|---|---|
| **Section I** | **PREVENTIVE MAINTENANCE** | |
| 1–1. | Periodic Inspection And Care | 1 |
| 1–2. | Importance Of Proper Fluid Level | 1 |
| 1–3. | Aerated Fluid | 1 |
| 1–4. | Fluid Level Check Procedure | 2 |
| 1–5. | Recommended Automatic Transmission Fluid And Viscosity Grade | 4 |
| 1–6. | Keeping Transmission Fluid Clean | 5 |
| 1–7. | Hydraulic System Pressures | 5 |
| 1–8. | Transmission Fluid And Filter Change Intervals | 6 |
| 1–9. | Transmission Fluid And Filter Change Procedures | 6 |
| 1–10. | Transmission Fluid Contamination | 7 |
| 1–11. | Breather | 8 |
| 1–12. | Linkage | 8 |
| 1–13. | Transmission Stall Test And Neutral Cool-Down Check | 9 |
| **Section II** | **REMOVING TRANSMISSION FROM COACH** | |
| 2–1. | Draining Transmission | 12 |
| 2–2. | Disconnecting Controls | 12 |
| 2–3. | Uncoupling From Driveline, Engine | 13 |
| 2–4. | Removing The Transmission | 13 |
| 2–5. | Rebuild, Overhaul Instructions | 14 |
| **Section III** | **PREPARING TRANSMISSION FOR INSTALLATION** | |
| 3–1. | Checking Input Components | 15 |
| 3–2. | Checking Output Components | 15 |
| 3–3. | Installing Range Selector Lever | 16 |
| 3–4. | Installing Shift Modulation Control | 17 |
| 3–5. | Installing Neutral Start And Reverse Signal Switches | 17 |
| 3–6. | Installing Fluid Filler Tube | 18 |
| 3–7. | Checking Plugs, Openings | 19 |

| Paragraph | Description | Page |
|---|---|---|
| **Section IV** | **PREPARING COACH FOR TRANSMISSION INSTALLATION** | |
| 4–1. | Checking Flexible Coupling | 20 |
| 4–2. | Checking Engine Flywheel | 20 |
| 4–3. | Checking Chassis, Driveline | 21 |
| 4–4. | Transmission Cooler, Filter, And Lines | 21 |
| 4–5. | Checking Controls | 21 |
| **Section V** | **INSTALLING TRANSMISSION INTO COACH** | |
| 5–1. | Handling | 23 |
| 5–2. | Mounting To Engine | 23 |
| 5–3. | Installing Transmission Mounting Components | 24 |
| 5–4. | Coupling To Driveline | 24 |
| 5–5. | Connecting Cooler, Filter, Scavenge Lines | 24 |
| 5–6. | Connecting Range Selector Control | 25 |
| 5–7. | Connecting Modulation Control | 26 |
| 5–8. | Installing Power Takeoff Components | 26 |
| 5–9. | Connecting Speedometer Drive | 26 |
| 5–10. | Connecting Electrical Components | 27 |
| 5–11. | Filling The Hydraulic System | 27 |
| **Section VI** | **TEST AND ADJUSTMENTS** | |
| 6–1. | Installation Checklist | 28 |
| 6–2. | Road Test And Coach Operation Checklist | 28 |
| 6–3. | Coach Operation Checklist | 28 |
| 6–4. | Installation Checklist | 29 |
| **Section VII** | **CUSTOMER SERVICE** | |
| 7–1. | Owner Assistance | 32 |
| 7–2. | Service Literature | 34 |

# PREFACE

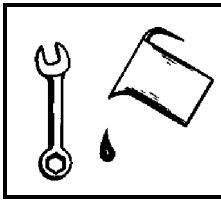
This handbook is a reference for the mechanic removing, installing, or maintaining the V730 Hydraulic Controls Automatic Transmission. All features of both the vehicle and transmission that become involved in the installation procedures are discussed. The information presented will help the mechanic to remove, install, and maintain the transmission in a manner that assures satisfactory operation and long service life.

# TRADEMARKS USED

DEXRON®-II, DEXRON®-IIE, and DEXRON®-III are registered trademarks of General Motors Corporation

Loctite® is a registered trademark of the Loctite Corporation

Teflon® is a registered trademark of the DuPont Corporation



# PREVENTIVE MAINTENANCE

SECTION
I

## 1–1. PERIODIC INSPECTION AND CARE

Clean and inspect the exterior of the transmission at regular intervals. The severity of service and operating conditions will determine the frequency of such inspections. Inspect the transmission for loose bolts, fluid leaks, and damaged or loose hydraulic lines. Fluid leaks require immediate attention. Linkage must be kept clean, properly adjusted, and lubricated. Check the transmission fluid level at the intervals specified in the coach operator's manual.

## 1–2. IMPORTANCE OF PROPER FLUID LEVEL



The transmission fluid cools, lubricates, and transmits hydraulic power. It is important that the proper fluid level be maintained at all times. If the fluid level is too low, the converter and clutches will not receive an adequate supply of fluid. If the level is too high, the fluid will aerate, the transmission will overheat, and fluid may be expelled through the breather or dipstick tube.

After overhaul or rebuild, the fluid system, including all external plumbing and components such as filter and heat exchanger, must be refilled.

Because the initial running of the engine after overhaul will cause a rapid draw-down of the transmission fluid level while the filter, heat exchanger and lines are filling, check the fluid level several times during the first few minutes the engine is running. Add fluid as needed to maintain the level within the COLD RUN band (refer to Paragraph 1–4).

## 1–3. AERATED FLUID

Aeration changes the viscosity and color of the transmission fluid to a milky liquid and adversely affects transmission performance. The primary causes of aeration are improper fluid, not enough fluid in the sump, too much fluid in the sump, or a defective or missing sealring on the intake pipe of the internal fluid filter.

A low fluid level will not completely envelop the internal filter. Therefore, fluid and air are drawn into the system by the input pump and are directed to the control circuits and converter causing converter cavitational noises.

A high fluid level (too much fluid) will cause the clutches to be partially immersed in the sump fluid. Rotation of the clutches churns the fluid causing it to become aerated. The aerated fluid can also cause overheating.

## 1–4. FLUID LEVEL CHECK PROCEDURE



Clean around the end of the fill tube before removing the dipstick. Dirt or foreign matter must not be permitted to enter the transmission because it can cause valves to stick, cause undue wear of transmission parts, or clog passages. Check the fluid level by the following procedures and record any abnormal level on your maintenance records.

Proper transmission fluid levels are shown in Figure 1–1. A typical fluid level dipstick is shown in Figure 1–2.

The fluid level should always be checked with the engine at idle speed, transmission in neutral, and coach on a level surface (parking brake applied).

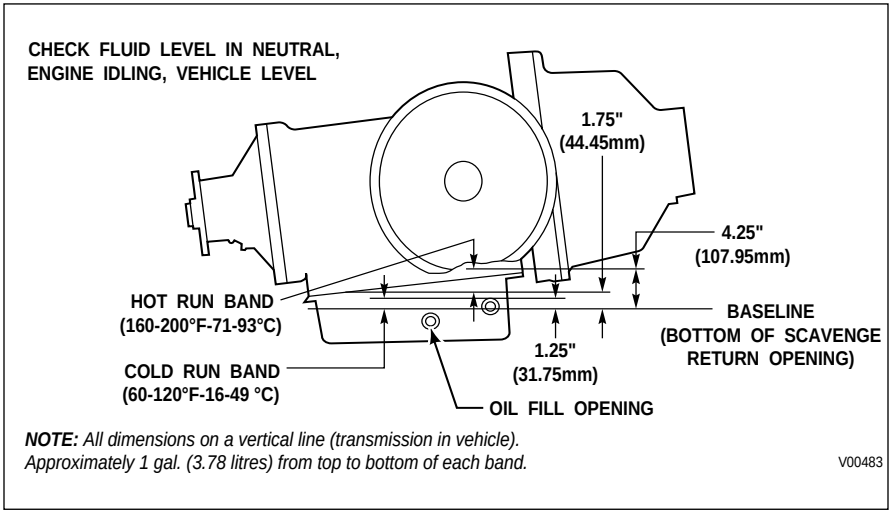



**FIGURE 1–1.** ***Transmission Fluid Levels***

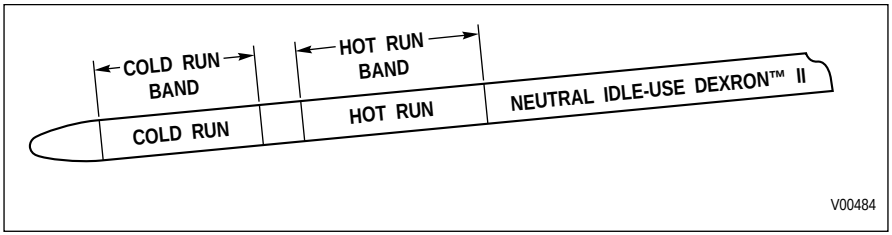



**FIGURE 1–2.** ***Typical Dipstick Markings***

Always check the fluid level at least twice. Consistency is important in maintaining accuracy. If inconsistent readings persist, check the transmission breather and the vent hole in the dipstick fill tube to ensure they are clean and free of debris. The vent hole is located on the underside of the fill tube just below the seal of the dipstick cap.

**CAUTION:** The fluid level rises as sump temperature increases. DO NOT fill above the Cold Run band if the transmission fluid is below normal operating temperature.
An unexplained increase in the amount of sump fluid requires immediate attention. A failed rear seal in the engine may be allowing engine oil to enter the transmission sump.

**a. Cold Check**

**NOTE:**
**The only purpose of the Cold Check is to determine if the transmission has enough fluid to be safely operated until a hot check can be made.**

- If the engine has been shut down for an extended time, run the engine for at least one minute. Shift to **D**rive and then to **R**everse to clear the hydraulic circuits of air. The sump temperature should be between 60–120°F (16–50°C).
- Park the coach on a level surface and shift to **N**eutral. Apply the parking and/or emergency brakes and allow the engine to idle (1000–1500 rpm).
- After wiping the dipstick clean, check the fluid level. If the fluid on the dipstick is within the COLD RUN band, the level is satisfactory for operating the transmission until the fluid is hot enough to perform a HOT RUN check. If the fluid level is not within the COLD RUN band, add or drain fluid as necessary to bring the level to the middle of the COLD RUN band.
- Perform a hot check after normal operating sump temperature of 160–200°F (71–93°C) is reached.

**b. Hot Check**



**NOTE:**
**The fluid must be hot to ensure an accurate check. The fluid level rises as temperature increases.**

- Drive the coach until the transmission fluid reaches normal operating temperature:
  - — 160–200°F (71–93°C) sump temperature
  - — 180–220°F (82–104°C) converter-out temperature
- Park the coach on a level surface and shift to **N**eutral. Apply the parking and/or emergency brakes and allow the engine to idle (1000–1500 rpm).
- After wiping the dipstick clean, check the fluid level. The safe operating level is anywhere within the HOT RUN band on the dipstick.
- If the level is not within this band, add or drain fluid as necessary to bring the level to the top of the HOT RUN band.

## 1–5. RECOMMENDED AUTOMATIC TRANSMISSION FLUID AND VISCOSITY GRADE

- Hydraulic fluids (oils) used in the transmission are important influences on transmission performance, reliability and durability. DEXRON®-IIE and/or DEXRON®-III fluids are recommended for on-highway applications. Type C-4 fluids are recommended for severe duty and off-highway applications.
- Some DEXRON®-IIE and/or DEXRON®-III fluids are also qualified as Type C-4 fluids. To ensure the fluid is qualified for use in Allison transmissions, check for a DEXRON®-IIE, DEXRON®-III, or C-4 fluid license*, or approval numbers on the container, or consult the lubricant manufacturer. Consult your Allison Transmission dealer or distributor before using other fluid types; fluid types such as Type F, and universal farm fluids may or may not be properly qualified for use in your Allison transmission.



**CAUTION**: Disregarding minimum fluid temperature limits can result in transmission malfunction or reduced transmission life.

- When choosing the optimum viscosity grade of fluid to use, duty cycle, preheat capabilities, and/or geographical location must be taken into consideration. Table 1–1 lists the minimum fluid temperatures at which the transmission may be safely operated. Preheat with auxiliary heating equipment or by running the equipment or vehicle with the transmission in Neutral for a minimum of 20 minutes before attempting range operation.

* DEXRON®-IIE (product license E-xxxxx) or DEXRON®-III (product license F-xxxxx) is recommended. However, DEXRON®-II (product license D-xxxxx) may be used until existing stock is depleted.

**TABLE 1–1. Operating Temperature Requirements for Transmission Fluid**

| Viscosity Grade | Ambient Temperature Below Which Preheat Is Required | |
|---|---|---|
| | **Fahrenheit** | **Celsius** |
| SAE 0W-20 | –22 | –30 |
| DEXRON®-III | –17 | –27 |
| DEXRON®-IIE | –17 | –27 |
| DEXRON®-II | –8 | –22 |
| SAE 10W | –4 | –20 |
| SAE 10W-30 | –4 | –20 |
| SAE 15W-40 | 5 | –15 |
| SAE 30 | 32 | 0 |
| SAE 40 | 50 | 10 |
| * Ref. pg. 3 of 13-TR-90. | | |

## 1–6. KEEPING TRANSMISSION FLUID CLEAN

Transmission fluid must be handled in clean containers, fillers, etc., to prevent foreign material entering the transmission. Lay dipstick in a clean place while filling the transmission.



**CAUTION:** Containers or fillers that have been used for any antifreeze or engine coolant solution must not be used for the transmission fluid. Antifreeze and coolant solutions contain ethylene glycol which, if introduced into the transmission, can cause the clutch plates to fail.

## 1–7. HYDRAULIC SYSTEM PRESSURES

Lubrication and control circuit pressures are satisfactory when they meet the following values.

- Main:
  - — **F**orward Drive ranges — 130 psi (896 kPa) min. at 500 rpm ± 50 rpm
  - — **N**eutral and **R**everse — 230–265 psi (1586–1827 kPa) at 1000 rpm ± 50 rpm
  - — Lubrication — 30 psi (207 kPa) min. at 2100 rpm ± 50 rpm

## 1–8. TRANSMISSION FLUID AND FILTER CHANGE INTERVALS

Transmission fluid and filter change frequency is determined by the coach vocation and by the filter equipment installed. Table 1–2 is a general guide. More frequent changes may be required when operations are subject to high levels of contamination or overheating.

**TABLE 1–2. Transmission Fluid and Filter Change Intervals**

| | |
|---|---|
| External Filter Element | Every 6 months |
| Change Fluid and Clean Governor Filter (Figure 1–3) | Every 12 months |
| Internal Filter in Sump | Clean or replace at overhaul |

## 1–9. TRANSMISSION FLUID AND FILTER CHANGE PROCEDURES

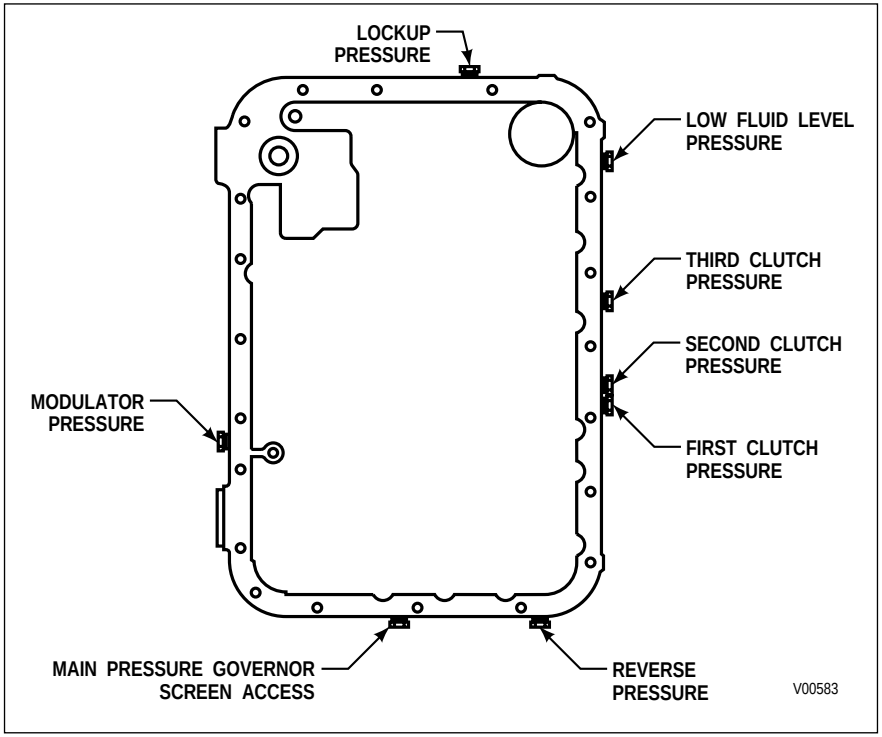



**FIGURE 1–3.** ***V730 Hydraulic Controls***

**a. Drain**

- The transmission should be at operating temperature (160–200°F; 71–93°C) when the fluid is drained. This will ensure quicker and better drainage.
- Remove the magnetic drain plug and washer (if present) from the sump and allow the fluid to drain. Examine the drain for metal particles. Examine the drained transmission fluid for evidence of contamination (refer to Paragraph 1–10). Reinstall the drain plug. Tighten the plug to 15–20 lb ft (20–27 N·m).
- Remove the governor filter access plug and remove the filter. Inspect the filter for debris and damage. Install a new or cleaned filter, open end first, back into the transfer plate. Install the access plug and tighten it to 4–5 lb ft (5.4–6.7 N·m).
- Clean or replace the filter element(s), as required.

**b. Fill**

- To refill the transmission, remove the dipstick and pour approximately 26 U.S. quarts (25 liters) of transmission fluid through the filler tube.
- After a complete overhaul (or for initial fill), add 34 U.S. quarts (32 liters). This amount does not include the fluid necessary to fill the external filter and cooler circuits. Note that the refill amount is less than the initial fill because some of the fluid remains in the external circuits and transmission cavities.
- Check the fluid level using the procedure described in Paragraph 1–4.

## 1–10. TRANSMISSION FLUID CONTAMINATION

**a. Examine at Fluid Change**

At each transmission fluid change, examine the fluid which is drained for evidence of dirt or water. A normal amount of condensation will emulsify in the fluid during operation of the transmission. However, if there is evidence of water, check the cooler (heat exchanger) for leakage between the water and fluid areas. Fluid in the water side of the cooler (heat exchanger) is another sign of leakage. This, however, may indicate leakage from the engine oil system.

**b. Metal Particles**

Metal particles in the transmission fluid or on the magnetic drain plug (except for the minute particles normally trapped in the filter) indicate damage has occurred in the transmission. When these particles are found in the sump, the transmission must be disassembled and closely inspected to find the source. Metal contamination will require complete disassembly of the transmission and cleaning of all internal and external circuits, cooler, and all other areas where the particles could lodge.



**CAUTION:** If excessive metal contamination has occurred, replacement of all bearings within the transmission is recommended.

### c. Coolant Leakage

If engine coolant leaks into the transmission hydraulic system, immediate action must be taken to prevent malfunction and possible serious damage. The transmission must be completely disassembled, cleaned, and inspected. All traces of the coolant, and varnish deposits resulting from coolant contamination must be removed. Friction clutch plates must be replaced.

## 1–11. BREATHER

The breather is located at the top of the transmission housing. It serves to prevent pressure buildup within the transmission and must be kept clean and the passage open. The prevalence of dust and dirt will determine the frequency at which the breather requires cleaning. Use care when cleaning the transmission. Spraying steam, water, and/or cleaning solution directly on the breather can force water and cleaning solution into the transmission.

Always use a wrench of the proper size to remove or replace the breather. Pliers or a pipe wrench can crush or damage the stem and produce metal chips which could enter the transmission.

## 1–12. LINKAGE

### a. Maintain Proper Adjustment

Proper adjustment of the manual selector valve linkage is important because the shift selector detents must correspond exactly to those in the transmission. Periodic inspections should be made for bent or worn parts, loose threaded connections, loose bolts, and accumulation of grease and dirt. All moving joints must be kept clean and well lubricated.

### b. Reference to Coach Manual

Refer to the coach manual for specific linkage adjustment procedures as different control systems may be used. The following general procedures are applicable to most coaches.

### c. Manual Selector Lever

- The manual selector lever should move easily and give a crisp detent feel in each position. The linkage should be adjusted so that the stops in the shift selector match the detents in the transmission.
- When the linkage is correctly adjusted, the pin which engages the shift lever linkage at the transmission can be moved freely in each range. **The shift lever will be freely positioned by the transmission detents.**



**CAUTION:** Manual selector shafts that are center drilled at their outer ends require an M10 x 1.56G nut (metric thread). Shafts that are not drilled require ⅜–16 nut (standard inch series). Use of the wrong nut will damage both the shaft and nut. Failure to hold the lever can damage the internal selector lever.

- To properly install the external lever, proceed as follows. Rotate the manual selector shaft to a position that is two detent notches from either end of its travel. Install the external lever so that the flat sides of the shaft opening are parallel to the flats on the shaft. Install the nut. While holding the lever against rotation, tighten the nut to 15–20 lb ft (21–27 N·m).

**d. Mechanical Modulator Control**

- To adjust mechanical (cable) modulator control, place the engine fuel or throttle control at full throttle position.
- Fully extend or push the control cable. (Systems are designed to either push or pull the cable when the throttle is opening.) Push or pull motion is translated to a single direction motion at the modulator valve by proper positioning of the actuator cam.
- Adjust the linkage so that the fuel control and cable end can be freely connected.
- Close and open the throttle fully. The cable or linkage must not bind. Travel of the cable (from closed to open throttle) must not be less than 1.19 inch (30.2 mm) nor more than 1.56 inch (39.6 mm).
- The modulator cable must follow throttle movement from open to closed position. It may be necessary to add spring force to cause the cable to follow.

**e. Air Actuated Modulator**

- Out of vehicle check — apply 80 psi (550 kPa) and submerge in water. Leaks are not permitted.

## 1–13. TRANSMISSION STALL TEST AND NEUTRAL COOL-DOWN CHECK



**a. Purpose**

The stall test provides a method for determining if the malfunction is in the engine or in the transmission when the coach powerpack is not performing satisfactorily.

The neutral cool-down check utilizes the two-minute cooling period on the stall test to gather fluid temperature data for troubleshooting reference.

### b. Transmission Stall Test Procedure

The actual engine stall point (rpm) under load is compared to the established normal speed specified by the engine manufacturer.



**NOTE:**
**The engine data for the test is available from the engine manufacturer or from your coach dealer or distributor.**

- Connect a tachometer of known accuracy to the engine, and install a temperature probe into the converter-out (to cooler) line. Bring transmission to the normal operating temperature of 180–220°F (82–104°C).



**WARNING:** When conducting a transmission stall test, the coach must be prevented from moving. Apply the parking brake and service brakes and block the coach securely. Warn personnel to keep clear of the coach and its travel path. Failure to do so can cause serious injury.



**CAUTION:** Never maintain the stall condition for more than 30 seconds at any one time because of the rapid rise in fluid temperature. Do not let the converter-out fluid temperature exceed 300°F (149°C). Do not rely on converter-out fluid temperature to limit stall duration. During stall conditions, internal temperatures rise much faster than converter-out fluid temperature. If the stall test is repeated, do not let the engine overheat.

- With the coach blocked, parking and service brakes applied, shift to any forward range. Then, accelerate the engine to wide-open throttle. Stabilize the converter-out fluid temperature at 255°F (107°C). Record the engine speed. (This test may also be conducted in reverse if necessary.)
- Reduce engine speed to idle and shift to **N**eutral.

### c. Neutral Cool-Down Check Procedure

The neutral cool-down check determines if the transmission fluid cools following an engine load condition. This check should be performed immediately after the engine speed has been recorded in the stall test.

- Record the converter-out fluid temperature.
- With the transmission remaining in **N**eutral, run the engine at 1200–1500 rpm for two minutes to cool the fluid.
- At the end of two minutes, record the converter-out fluid temperature.

**d. Results**



**NOTE:**
**Environmental conditions, such as ambient temperature, altitude, engine accessory loss variations, etc., affect the power input to the converter. Under such conditions, a stall speed deviation up to ± 150 rpm from specification can be accepted as within normal range.**

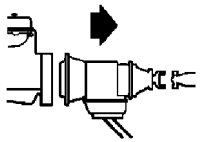
If engine stall speed is more than 150 rpm below the stall speed specified by the engine manufacturer, an engine problem is indicated, such as need for tune-up.

If engine stall speed is more than 150 rpm above specification, a transmission problem is indicated, such as slipping clutches, cavitation, or torque converter failure.

An extremely low stall speed, such as 33 percent of the specified engine stall rpm, during which the engine does not smoke, could indicate a freewheeling stator.

If the engine stall speed conforms to specification, but the transmission fluid overheats, refer to the cool-down check. If the fluid does not cool during the two-minute cool-down check, a stuck stator could be indicated.

If the engine stall speed conforms to specification and the cool-down check shows that transmission fluid cools properly, refer to the Troubleshooting Manual for troubleshooting procedures.

| SECTION II | REMOVING TRANSMISSION FROM COACH |  |
|---|---|---|

## 2–1. DRAINING TRANSMISSION

The transmission should be drained before it is removed from the coach.

- The transmission should be at operating temperature (160–200°F; 71–93°C) when the fluid is drained. This will ensure quicker and better draining.
- Remove the magnetic drain plug and washer (if present) from the sump and allow the fluid to drain. Examine the drain plug for metal particles. Examine the drained transmission fluid for evidence of contamination (refer to Paragraph 1–10). Reinstall the drain plug.
- Remove fill tube assembly if it will interfere during transmission removal.
- Disconnect all other hydraulic lines from the transmission and allow them to drain. Remove any other lines from the coach if they will interfere during transmission removal. Cover or plug the lines and all openings to keep dirt from entering the hydraulic system.

## 2–2. DISCONNECTING CONTROLS



**CAUTION:** Use of impact wrench requires means to hold selector shaft to prevent internal damage.

Controls, if not completely removed, should be disconnected from transmission and positioned so they do not interfere with transmission removal.



**NOTE:**
**On models with a splined range selector shaft, mark the transmission range selector lever with a center punch adjacent to the index mark on the selector shaft before removing the lever, if a mark is not already present on the lever. Do not use excessive force to remove the lever. Failure to work the lever carefully from the shaft will cause internal damage.**

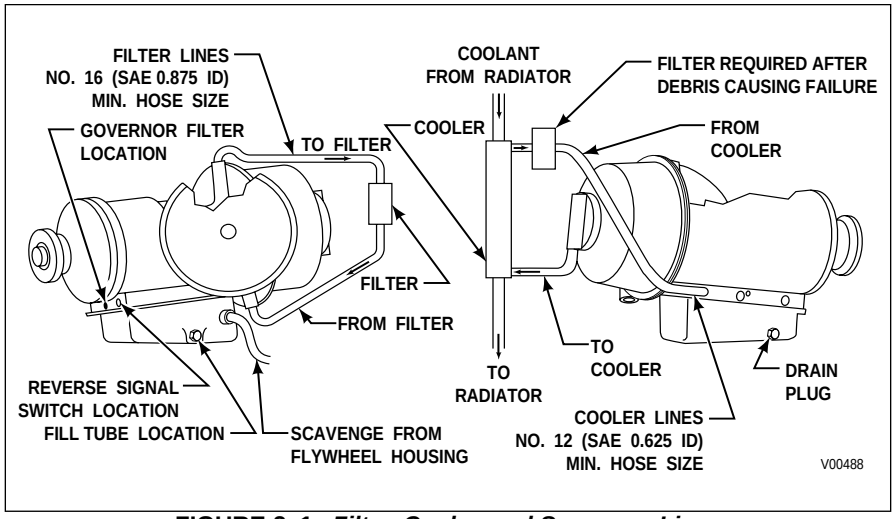
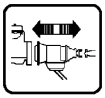



**FIGURE 2–1.** ***Filter, Cooler, and Scavenge Lines***

- Disconnect all linkage or cables for shifting, shift modulation, and speedometer.
- Disconnect the pneumatic line from the shift modulator.
- Remove drive belt(s) from the power takeoff pulley (if so equipped). The pulley nut, pulley, and key can be removed from the shaft, if desired.
- Disconnect electrical leads from the neutral start switch, reverse signal switch, and fluid temperature or pressure sensors.
- Remove the scavenge line that connects the engine flywheel housing to the transmission sump (Figure 2–1).

## 2–3. UNCOUPLING FROM DRIVELINE, ENGINE



- Disconnect the coach driveline from the transmission output flange. Position the disconnected shaft to avoid interference with transmission removal.
- Support the transmission securely on a hoist, jack, or other suitable removal equipment.
- Remove all bolts, nuts, washers, spacers, and supports that attach the transmission to the coach and to the engine.

## 2–4. REMOVING THE TRANSMISSION

- Move the transmission away from the engine, being careful so that the stub shaft does not fall out (Figure 2–2). The stub shaft can be seen, and supported

if necessary, after the transmission is moved approximately 5 inches (125 mm) away from the engine.

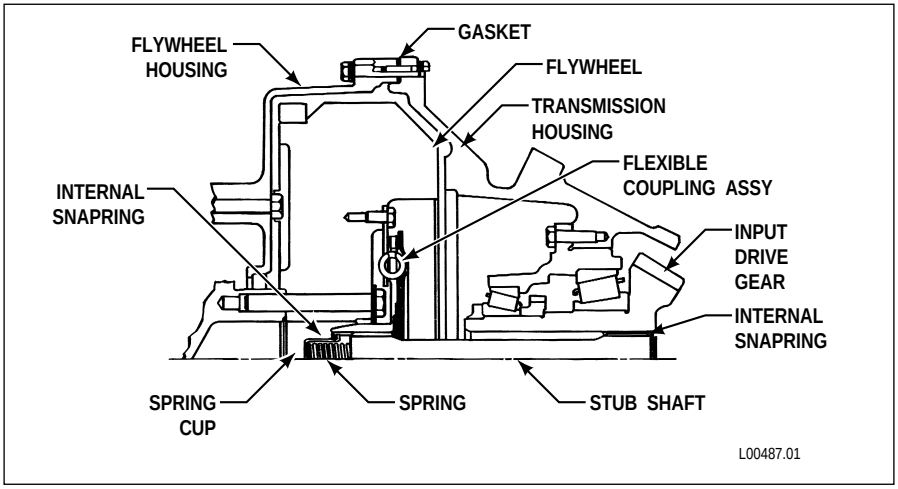
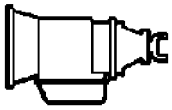



**FIGURE 2–2.** ***Engine-to-Transmission Drive Components — Typical Arrangement***

- Continue to move the transmission away from the engine until it is entirely clear of the coach. Remove the stub shaft. Remove the transmission-to-engine gasket.
- Install the support adapter on the transmission, and mount the transmission on a turnover stand or other suitable fixture.
- Remove the stub shaft retaining spring and spring cup from the center of the flexible coupling assembly.
- Refer to the coach manual for service instructions on the flexible coupling assembly.

## 2–5. REBUILD, OVERHAUL INSTRUCTIONS

Refer to the latest edition of Service Manual SA1444 for rebuild or overhaul of the transmission.



# PREPARING TRANSMISSION FOR INSTALLATION

SECTION
**III**

## 3–1. CHECKING INPUT COMPONENTS

- Inspect the internal splines of the input drive gear for burrs or any obstruction that will prevent free insertion of the stub shaft. Insert the stub shaft into the drive gear and make sure it will seat against the internal snapring in the drive gear (Figure 2–2). Remove the stub shaft.
- Inspect the stub shaft for cracks, spline wear or damage, and burrs. Replace the shaft if worn or damaged.
- Inspect the transmission-to-engine mounting flange for raised metal, burrs, and pieces of gasket material. Remove any of these defects. Inspect the threaded holes for damaged threads. Clean the threads with a used ⅜–16 tap, if necessary.

## 3–2. CHECKING OUTPUT COMPONENTS

- Before removing the output flange retaining nut, check to see how many notches have been cut into the wrenching flats. If there are five notches, the nut must be thrown away if it is removed.
- If there are less than five notches, or none at all, remove all dirt and any burrs from the exposed shaft threads. Then, only loosen the nut until there is approximately 1⁄16 inch (1.59 mm) gap between the nut and flange.
- Check the running torque while removing the nut. The nut can be reused only if it meets the following requirements.
  - — The first time (no notches) the nut is removed the running torque must be at least 400 lb in. (45 N·m).
- Each additional time (one to four notches) the nut is removed the running torque must be at least 300 lb in. (34 N·m).
- Each time the nut is reused, deeply scribe one of the wrenching flats. This method of marking the nut will indicate how many times the nut has been reused.

- Before installing the retaining nut, coat the threads with molybdenum disulfide grease, C-4 fluid, or DEXRON®-IIE or DEXRON®-III fluid. Install the flange retaining washer and nut.

**CAUTION:** The use of an impact wrench requires a means to hold the flange. Failure to hold the flange can cause internal damage to the transmission.

- Tighten the nut to 600–800 lb ft (814–1084 N·m).
- Inspect the output flange for burrs and raised metal that could prevent proper coupling of the coach driveline to the flange. Remove these defects with a honing stone.

## 3–3. INSTALLING RANGE SELECTOR LEVER

- Install the selector lever onto the selector shaft (Figure 3–1). The flats in the lever will tighten against the tapered flats on the shaft before the lever seats on the shaft shoulder.

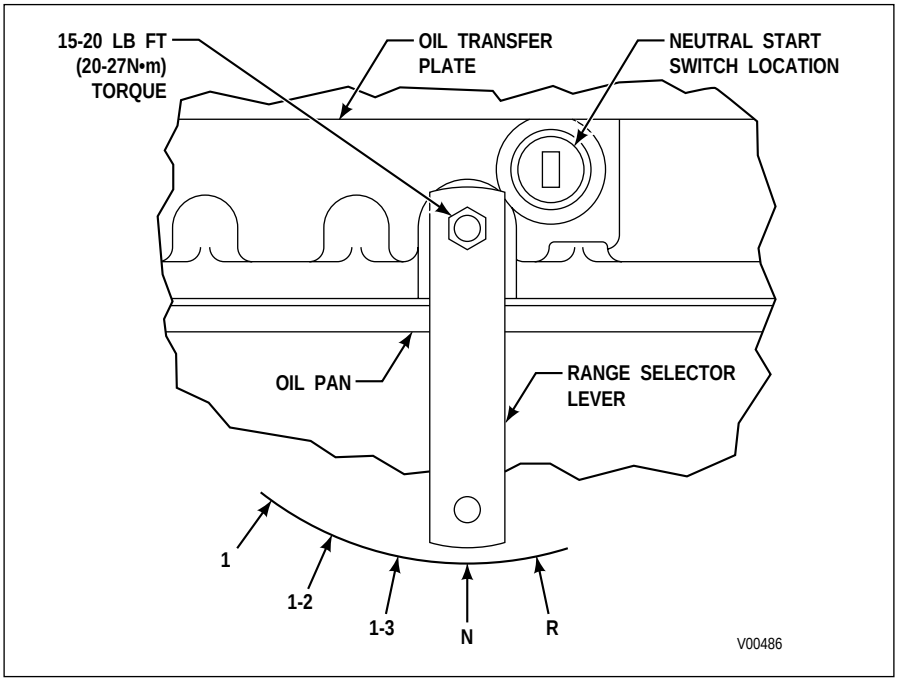



**FIGURE 3–1.** ***Range Selector Lever Installed—Typical***

**CAUTION:** Manual selector shafts that are center drilled at their outer ends require an M10 x 1.5–6G nut (metric thread). Shafts that are not drilled require a 3/8–16 nut (standard inch series). Use of the wrong nut will damage both shaft and nut.

- Install the lever retaining nut, finger-tight, against the lever.
- Shift the selector shaft to a position away from either end position. Two detent "clicks" from either end position is recommended.

**CAUTION:** Overtightening the nut can damage the internal selector lever.

- Hold the lever securely, with a wrench, to prevent its movement while tightening the nut to 15–20 lb ft (20–27 N·m). Do not use an impact wrench.

## 3–4. INSTALLING SHIFT MODULATION CONTROL

Install the modulator actuator unit into the transmission as follows.

- Lubricate a new O-ring seal with oil-soluble grease, and install it onto the stem of the actuator.
- Install the actuator into its mounting hole (Figure 3–2). The threaded part of the actuator should be positioned toward the top of the transmission.
- Retain the actuator with the spring clip and 5/16–18 x 5/8 inch bolt provided. The convex side of the formed end of the clip must be toward the transmission, and against the shoulder of the actuator stem. Tighten the bolt to 10–13 lb ft (14–18 N·m).

## 3–5. INSTALLING NEUTRAL START AND REVERSE SIGNAL SWITCHES

- Apply Loctite® Sealant with Teflon®, if desired, onto the threads of the neutral start switch. Install the neutral start switch into the tapped opening near the range selector shaft (Figure 3–2). The switch must include an aluminum washer (gasket) approximately 0.090 inch (2.29 mm) thick for earlier models and 0.030 inch (0.76 mm) thick for later models. Tighten the switch to 50–60 lb ft (68–81 N·m).

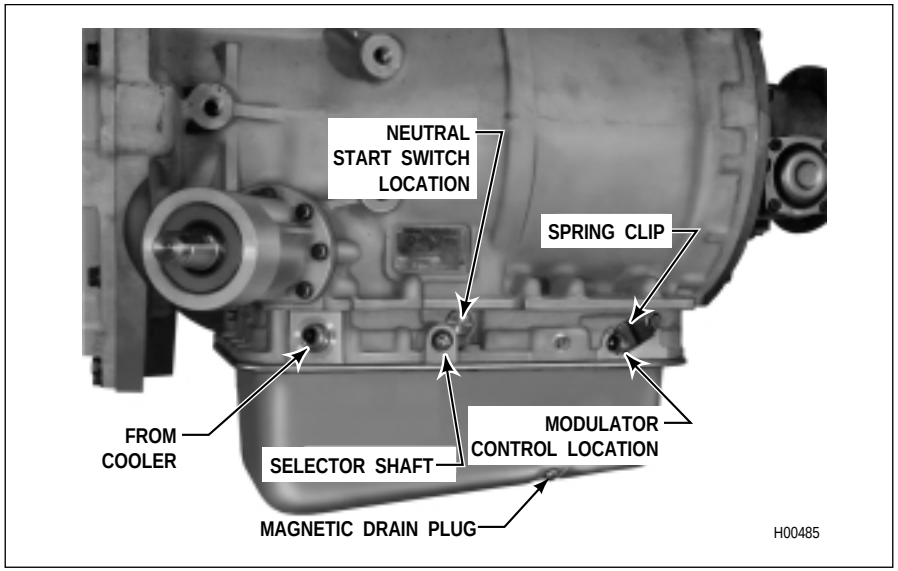



**FIGURE 3–2.** ***Partial View of Transmission Right Side***

- If the neutral start switch is not mounted at this location, the opening must be plugged with a ¾–16 plug with its head seated on a rubber-coated washer.
- If so equipped, install the reverse signal switch into the ⅛ inch pipe-threaded opening nearer the engine side, at the front of the transmission (Figure 2–1). Tighten the switch to 4–5 lb ft (5.5–6.7 N·m).

## 3–6. INSTALLING FLUID FILLER TUBE

- Check to ensure that the fluid filler tube is properly vented. A vent hold should be located on the underside of the tube and just below the seal of the dipstick cap. The hole diameter should be 0.060–0.080 inch (1.53–2.03 mm).
- The fluid filler tube may be installed before the transmission is installed into the coach, unless its presence will interfere with transmission installation.
- Install the fluid filler tube, aligning its brackets with their attachment locations.
- Attach brackets to their mountings (on transmission).
- Tighten the filler tube nut at the sump to 90–100 lb ft (123–135 N·m).

## 3–7. CHECKING PLUGS, OPENINGS

Check carefully at all sides of the transmission for loose or missing fluid pressure check plugs.

- The ⅛ inch pipe plugs should be tightened to 4–5 lb ft (5.5–6.7 N·m).
- Check the scavenge fluid return line opening (near filler tube), and the four openings into which the cooler and filter lines connect, for cleanliness. Remove any closures or obstructions. Check the main electrical connector in the transmission housing for cleanliness.
- Check the drain plug for tightness. The drain plug must be tightened to 15–20 lb ft (20–27 N·m).

| SECTION IV | PREPARING COACH FOR TRANSMISSION INSTALLATION |  |
|---|---|---|

## 4–1. CHECKING FLEXIBLE COUPLING

- Inspect the flexible coupling that is bolted to the engine flywheel (Figure 2–2). Check for cracks, weak or broken springs, damaged or worn splines, and tightness of the mounting bolts. Replace the coupling assembly if it is unserviceable.
- Tighten the eight bolts retaining the coupling to the manufacturer's torque specification.
- Wire the coupling mounting bolts in pairs with lockwire.
- Install the stub shaft retaining spring cup, smaller end first, into the splined hub of the flexible coupling. The flared lip of the cup must seat against the internal snapring in the hub.
- Insert the stub shaft into the splined hub of the flexible coupling to determine if it will enter freely. Check the splined bevel gear in the transmission in the same manner. Remove the stub shaft.
- Inspect the stub shaft retaining spring for cracks or distortion. Replace the spring if unfit for service.
- Install the spring into the splined hub, and push it into the spring cup.

## 4–2. CHECKING ENGINE FLYWHEEL

- Check the crankshaft end play for conformance to the engine manufacturer's limits.
- Check the concentricity of the splined diameter of the flexible coupling assembly with the inside diameter of the engine flywheel housing at the transmission mounting surface. Runout should not exceed 0.010 inch (0.25 mm).
- Check the transmission mounting surface on the engine flywheel housing for burrs, raised metal, or pieces of gasket material. Remove these defects to ensure that the transmission, when installed, will seat solidly and squarely.
- Check the threaded holes in the engine flywheel housing for dirt, burrs and damaged threads. Clean the threads with a used ⅜–16 tap, if necessary.

## 4–3. CHECKING CHASSIS, DRIVELINE

Inspect the chassis and driveline for the following, and correct any faulty conditions found.

- Broken or worn transmission mounts
- Damaged or missing isolators (rubber mounts)
- Improper or damaged bolts, hardware
- Driveline yoke slip joints for freedom of movement, wear, damage, lubrication, and correct indexing
- Universal joints for freedom of movement, wear, damage, lubrication, and correct indexing
- Backlash in coach differential (refer to coach manufacturer's specifications)
- Universal joint coupling at differential
- PTO belts, pulleys, driven equipment

## 4–4. TRANSMISSION COOLER, FILTER, AND LINES

Clean and inspect chassis- and transmission-related plumbing as follows, and correct any faulty conditions found.

- Inspect cooler and related coolant lines
- Clean and flush both the coolant and fluid sides of the cooler. Pressure check both sides using a 40 psi (275 kPa) air supply.
- Clean and flush the cooler connecting lines; inspect for deterioration, faulty connectors, kinks
- Clean and replace external filter element(s); inspect fittings, threads, mountings
- Clean and flush filter lines; inspect for faulty connectors, deterioration, kinks

## 4–5. CHECKING CONTROLS

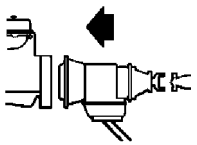
Inspect transmission control components on the coach for the following, and correct each faulty condition.

- Range selector for freedom of operation, frayed or kinked cables, lubrication, wear, loose parts, damaged threads, and proper routing
- Pneumatic shift modulator components for freedom of operation, condition of hose and fittings, proper pressure calibration (engine throttle must go to full-throttle position when accelerator is fully depressed)



**NOTE:**
**Coach air pressure input of 50–60 psi (345–414 kPa) is required for pneumatic control.**

- Speedometer drive cable for wear, damage, kinks, lubrication, and proper routing
- Wiring and related electrical components of signals, sensors, or switches for poor connections, frayed wiring, and damage



# INSTALLING TRANSMISSION INTO COACH

SECTION V

## 5–1. HANDLING

- Handle the transmission carefully to prevent damage to components in the vicinity of the installation path.
- Use a hoist or transmission jack of a type that permits precise control of transmission movements during installation.

## 5–2. MOUNTING TO ENGINE

- Install studs (if used) into the tapped holes in the transmission.
- Check the engine-to-transmission stub shaft to ensure that it freely engages both the engine and transmission.
- Grease splines on both ends of the stub shaft with petrolatum. Install the end that is **not** copper plated into the hub of the flexible coupling on the engine flywheel.

**NOTE:**
**Some installations may use a stub shaft marked in a different manner for installation. Refer to the coach manufacturer's instructions.**

- Install ⅜–16 x 3 inch headless guide bolts into the two tapped holes that are the greatest distance apart on the transmission mounting flange (not required if studs are installed).
- Install the transmission-to-engine gasket onto the transmission.
- Position the transmission directly in line with the engine crankshaft center line.
- Move the transmission, in a straight line, directly toward the engine, guiding the headless bolts into corresponding holes in the engine flywheel housing.

**CAUTION:** Do not use force. The transmission should move to within approximately 1½ inches (40 mm) of the engine before any resistance is felt.

- When resistance to further movement is felt, rotate the engine crankshaft very slowly until the stub shaft splines engage the splines in the transmission input drive gear. If the transmission is equipped with a power takeoff, the PTO shaft can be rotated to allow spline engagement.
- Continue to move the transmission toward the engine until its mounting flange and gasket seat squarely on the engine flywheel housing flange.
- Install four SAE Grade 5, ⅜–16 mounting bolts and lockwashers, finger tight, at 90° positions around the mounting flanges.
- Remove the headless guide bolts, and install the remaining twelve bolts and lockwashers, finger tight.
- Tighten four equally spaced bolts to 10–12 lb ft (14–16 N·m).
- Tighten all sixteen bolts to 26–32 lb ft (36–43 N·m).

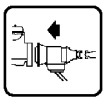
## 5–3. INSTALLING TRANSMISSION MOUNTING COMPONENTS



**CAUTION:** Use the type and grade of mounting bolts recommended by the coach manufacturer.

- Install all bolts, washers, spacers, isolators or supports required to support the transmission in the coach frame.
- Tighten the bolts to the torque recommended by the coach manufacturer.

## 5–4. COUPLING TO DRIVELINE



- Couple the driveline companion flange or universal joint yoke to the flange or yoke on the transmission. Use the bolts and torque recommended by the coach manufacturer.
- Check the universal joint angularity (all joints in driveline) to determine if they are within the specifications of the coach manufacturer.

## 5–5. CONNECTING COOLER, FILTER, SCAVENGE LINES

Figure 5–1 shows the cooler and filter line sizes, locations, and arrangement.

- Be sure that fluid lines are of the proper size and type recommended. Use new O-ring seals where required.
- Install and connect the scavenge fluid line at the bottom of the engine flywheel housing and at the sump (near filler tube).
- Secure the filler tube bracket(s) as required.
- Connect the fluid lines to the transmission and to the cooler and external filter, checking to see that the lines are clean and unobstructed.

- Tighten the line fittings in the transmission to not more than 50 lb ft (68 N·m).
- Check for sharp bends, kinks, twists, and contact with components that will chafe or collapse the hydraulic lines.
- Check for proximity to manifolds or exhaust pipes. Excessive heat will hasten the deterioration of hydraulic lines.
- Recheck the routing of all lines with Figure 5–1.

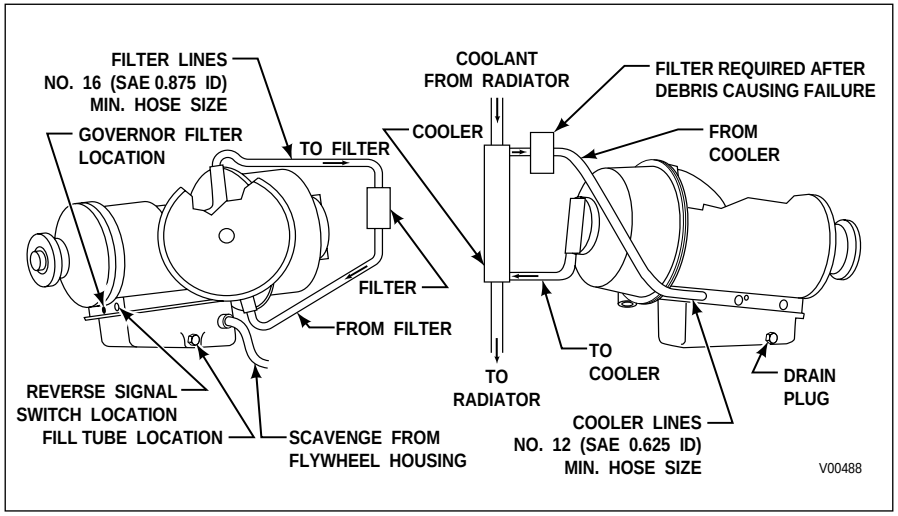



**FIGURE 5–1.** ***Filter, Cooler, and Scavenge Fluid Lines***

**NOTE:**
**An external filter must be installed in the line from the cooler after a debris-causing failure. This is to prevent debris, trapped in the cooler circuit, from coming loose and re-entering the transmission.**

## 5–6. CONNECTING RANGE SELECTOR CONTROL

- Select **R**everse at the shift selector. Place the transmission selector lever at the reverse position (last detent at extreme counterclockwise position).
- Adjust linkage so that rod end or clevis pin hole registers with hole in the transmission selector lever. Connect the linkage to the lever.
- Shift through all selector positions, checking each to ensure that the valve body detents correspond with respective shift selector positions.

## 5–7. CONNECTING MODULATION CONTROL

- Connect the air line (hose), that comes from the “Tee” or junction of the accelerator-to-engine fuel control air line, to the transmission modular control.
- Loosen the 5⁄16–18 bolt that retains the modulator control on the transmission to readjust the angle of the modulator control if necessary. Retighten the bolt to 10–13 lb ft (14–18 N·m) torque.
- Check the modulator for leakage. The modulator should not permit air to escape into the transmission when the accelerator pedal is fully depressed and the engine shut down. Listen carefully to detect leakage.
- Check the routing of the air line to ensure that the line is not twisted, kinked, will not chafe, and is not too near the exhaust manifold or exhaust pipe.

## 5–8. INSTALLING POWER TAKEOFF COMPONENTS

- Rotate the engine until the keyway in the PTO shaft is at the top of the shaft.
- Install the key into the shaft keyway.
- Install the PTO drive pulley (and belts, if there will be insufficient slack to easily install later) onto the PTO shaft.
- Install the self-locking nut to retain the pulley. Hold the pulley to keep the torque load off the drive gears in the transmission, and tighten the nut to 250–275 lb ft (339–372 N·m). Do not use an impact wrench to tighten the nut.



**CAUTION:** Exceeding the prescribed belt loads (tension plus load pull) will impose undue side loads on the PTO drive components.

- Adjust the belt tension to conform to the coach manufacturer’s recommendations.

## 5–9. CONNECTING SPEEDOMETER DRIVE

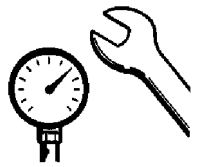
- Install the speedometer drive gear assembly into the transmission. Tighten the gear assembly in the transmission rear cover to 65–75 lb ft (89–101 N·m). If no speedometer drive is provided, be sure the plug is installed to close the hole in the housing (torque is same as for gear assembly).
- Install the speedometer drive cable onto the driven gear assembly. Tighten the nut to 50 lb in. (5.65 N·m). Avoid kinks or sharp bends in the cable assembly. Bends must have a minimum radius of 6 inches (150 mm).

## 5–10. CONNECTING ELECTRICAL COMPONENTS

- Connect the wire leads to the neutral start switch. Make sure the rubber shield (if provided) is properly installed.

## 5–11. FILLING THE HYDRAULIC SYSTEM

- Select the transmission fluid to be used. (Refer to Paragraph 1–5.)
- Fill the transmission with the required amount of fluid. (Refer to Paragraph 1–9.)
- Run the engine for about one minute and check the fluid level. (Refer to Paragraph 1–4.)

| SECTION VI | TEST AND ADJUSTMENTS |  |
|---|---|---|

## 6–1. INSTALLATION CHECKLIST



- Complete the Installation Checklist located in this section.
- Check the neutral start circuit by trying to actuate the starter at all selector positions. The starter should operate only when the transmission is in **N**eutral.

## 6–2. ROAD TEST AND COACH OPERATION CHECKLIST



- Refer to Operator's Manual (SA1493) for operating instructions.
- Drive the coach to determine if the transmission is functioning properly. The test drive should include a variety of conditions and terrain that will reveal any deficiency in transmission operation, or need for adjustment.
- Check all instruments associated with the transmission. These include transmission fluid pressure and temperature gages and speedometer.
- Complete the Road Test and the Coach Operation Checklist located in this section.
- Refer to the latest issue of the V730 Service Manual (SA1444) for detailed instructions for service and maintenance of the transmission and electronic control components.

## 6–3. COACH OPERATION CHECKLIST

- ❑ Neutral Start (starts only in **N**eutral) YES NO
- ❑ Reverse Warning Functional YES NO
- ❑ Transmission Fluid Level (cold, **N**eutral, idle) _____
- ❑ Full Throttle Upshifts mph output shaft rpm
- ❑ 1C–2C
- ❑ 2C–2L
- ❑ 2L–3L

- ❑ Closed Throttle Downshift
- ❑ 3–2
- ❑ 2–1
- ❑ Lockup out
- ❑ Max Speed in 1st Hold
- ❑ Max Speed in 2nd Hold
- ❑ Coach Top Speed in 3rd Lockup
- ❑ Shift Quality
- ❑ Transmission Fluid Level (hot, **N**eutral, idle)
- ❑ Stall Check
- ❑ Leak Checks
- ❑ Comments:

_____

_____

_____

_____

_____

_____

## 6–4. INSTALLATION CHECKLIST

- **PROPER TORQUE**
  - ❑ Flexible coupling bolts*
  - ❑ Transmission-to-engine bolts — 26–32 lb ft (36–43 N·m)
  - ❑ Transmission-to-frame or mounting bolts*
  - ❑ Output flange nut — 600–800 lb ft (814–1084 N·m)
  - ❑ Companion flange or universal joint bolts*
  - ❑ Selector lever nut — 15–20 lb ft (20–27 N·m)

* Tighten to coach manufacturer's recommendation.

- ❑ PTO pulley nut — 250–275 lb ft (339–372 N·m)
- ❑ Modulator control retainer bolt — 10–13 lb ft (14–18 N·m)
- ❑ Filler tube nut — 90–100 lb ft (123–135 N·m)
- ❑ Speedometer cable nut — 50 lb in. (5.65 N·m) max
- ❑ Speedometer body — 60–75 lb ft (89–101 N·m)
- ❑ Neutral start switch — 50–60 lb ft (68–81 N·m)
- ❑ Reverse signal switch — 4–5 lb ft (5.5–6.7 N·m)
- ❑ Hydraulic lines-to-transmission — 50 lb ft (68 N·m) max
- ❑ Governor filter access plug — 4–5 lb ft (5.4–6.7 N·m)
- ❑ Magnetic drain plug — 15–20 lb ft (20–27 N·m)

- **FLUID LINES (cooler, filter, scavenge)**
  - ❑ Check for leaks
  - ❑ Check for tightness of connections
  - ❑ Check for routing

- **LINKAGE**
  - ❑ Manual selector
  - ❑ Adjustment at all range positions
  - ❑ Crisp feel at each detent position
  - ❑ Ease of shifting
  - ❑ Neutral-start switch (starts only in neutral)
  - ❑ Modulator control
  - ❑ Adjustment
  - ❑ Proper operation
  - ❑ Routing of air lines
  - ❑ Air leakage

- **DRIVELINE**
  - ❑ Check for proper indexing of universal joints
  - ❑ Check for proper driveshaft angles

- ❑ Check driveline backlash
- ❑ Lubricate universals and slip-joints

- **HYDRAULIC SYSTEM**
  - ❑ Recommended fluid (DEXRON®-IIE or DEXRON®-III or C-4 transmission fluid)
  - ❑ Proper fluid level in transmission
  - ❑ Dipstick properly calibrated
  - ❑ Filler tube vented
  - ❑ Filler tube tight at sump
  - ❑ Filler cap tight
  - ❑ Breather clean, free of restriction
  - ❑ Check for fluid leaks during operation

- **POWER TAKEOFF**
  - ❑ Properly coupled to drive equipment
  - ❑ Proper belt tension

- **INSTRUMENT, ELECTRICAL EQUIPMENT**
  - ❑ Speedometer connected
  - ❑ Check wiring and electrical connections
  - ❑ Check reverse signal circuit
  - ❑ Check neutral-start circuit
  - ❑ Instruments, gages function properly

| SECTION VII | CUSTOMER SERVICE |  |
|---|---|---|

## 7–1. OWNER ASSISTANCE

The satisfaction and good will of the owners of Allison transmissions are of primary concern to Allison Transmission Division (ATD), its distributors, and their dealers.

As an owner of an Allison transmission, you have service locations throughout the world that are eager to meet your parts and service needs with:

- Expert service by trained personnel
- Emergency service 24 hours a day in many areas
- Complete parts support
- Sales teams to help determine your requirements
- Product information and literature

Normally, any situation that arises in connection with the sale, operation, or service of your transmission will be handled by the distributor or dealer in your area (check the telephone directory for the Allison Transmission service outlet nearest you).

Reference the Sales and Service Directory (SA2229) for the current listing of Allison Transmission authorized distributor and service dealers.

We recognize, however, that despite the best intentions of everyone concerned, misunderstandings may occur. To further assure your complete satisfaction, we have developed the following three-step procedure to be followed in the event a problem has not been handled satisfactorily.

**STEP ONE — Discuss the problem with a member of management from the distributorship or dealership.** Frequently, complaints are the result of a breakdown in communication and can quickly be resolved by a member of management. If you have already discussed the problem with the Sales or Service Manager, contact the General Manager. All ATD dealers are associated with an ATD distributor. If the problem originates with a dealer, explain the matter to a management member of the distributorship with whom the dealer has his service agreement. The dealer will provide his ATD distributor's name, address, and telephone number on request.

**STEP TWO —** When it appears the problem cannot be resolved readily at the distributor level without additional assistance, **contact the Allison Transmission**

**Regional Office responsible for the local distributor.** You will be assisted by a member of the Regional Service Manager's staff, depending on the nature of the problem. For prompt assistance, please have the following information available.

- Name and location of authorized distributor or dealer
- Type and make of equipment
- Transmission model number, serial number, and assembly number (if equipped with electronic controls, also provide the ECU assembly number)
- Transmission delivery date and accumulated miles, and/or hours of operation
- Nature of problem
- Chronological summary of unit's history

**STEP THREE —** If you contacted a regional office and you are still not satisfied, **present the entire matter to the Home Office by writing to the following address or calling the phone number below:**

Manager Warranty Administration — PF9
Allison Transmission
PO Box 894
Indianapolis IN 46206–0894
Phone (317) 242-3538

The inclusion of all pertinent information will assist the Home Office in expediting the matter. If an additional review by the Home Office of all the facts involved indicates that some further action can be taken, the Regional Office will be advised.

When contacting the Regional or Home Office, please keep in mind that ultimately the problem will likely be resolved at the distributorship or dealership utilizing their facilities, equipment, and personnel. Therefore, it is suggested the above steps be followed in sequence when experiencing a problem.

Your purchase of an Allison Transmission product is greatly appreciated, and it is our sincere desire to assure complete satisfaction.

## 7–2. SERVICE LITERATURE



Additional service literature is available. This service literature provides fully illustrated instructions for the operation, maintenance, service, overhaul, and parts support of your transmission. To ensure that you get maximum performance and service life from your unit, see your dealer or distributor for the following publications. Check the telephone directory for the Allison Transmission service outlet nearest you.

**TABLE 7–1.**

| Driver's Handbook | Service Manual | Parts Catalog |
|---|---|---|
| SA1493 | SA1444 | SA1442 |




MT1494EN 199401 www.allisontransmission.com Printed in USA